

# Laser Ignition of Traumatically Embedded Firework Debris

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**Background and Objective:** The Q-switched ruby laser (QSRL) has a good track record for traumatic tattoo removal. An unusual case of QSRL-treatment of a traumatic tattoo composed of firework debris is presented.

**Study Design/Patient and Method:** A young man's traumatic tattoo, composed of firework debris, underwent QSRL ablation at 4–7 J/cm<sup>2</sup> (pulse width 5 mm; duration 20 ns).

**Results:** Each test pulse produced visible sparks and focal projectile ejection of skin with pox-like scar formation.

**Conclusion:** Caution is advised when using the QSRL for the treatment of traumatic tattoos composed of potentially combustible debris. *Lasers Surg. Med.* 22:157–158, 1998.

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**Key words:** Q-switched ruby laser; traumatic tattoo; firework debris

## INTRODUCTION

The use of Q-switched lasers, including the ruby, alexandrite, and Nd:YAG, for the removal of tattoos has been firmly established [1–8]. Such devices are able to remove unwanted pigment with relatively low risks of scarring and permanent adverse pigmentary changes. Moreover, the successful use of these same lasers for the improvement of traumatic tattoos has been reported [9–13]. While most traumatic tattoos involve the implantation of asphalt, gravel, earth, and vegetative matter, occasionally traumatic tattoos may involve the deposition of combustible materials such as gunpowder. Experience in the treatment of the latter type of traumatic tattoos is limited. This is a case report of a young man with a traumatic tattoo composed of firework debris.

## SUBJECT AND METHODS

With no significant past medical history and on no medications, M.B. is a 31-year-old white male who presented for possible laser ablation of a cosmetically disfiguring traumatic tattoo involving primarily his face. Four months prior, he had an accident while loading black gunpowder into a

cannon as part of a Fourth of July fireworks display. Unfortunately, the gunpowder was prematurely ignited and a backlash of explosive particles hit him quite strongly in the face. The patient underwent immediate surgical debridement to remove a substantial portion of the gunpowder. However, he was left with approximately 30–40 dark-blue dots on his face. Each of these dots measured 2–3 mm in diameter. In some cases, these dots were associated with a slight depression of the skin and in other areas there was minimal elevation. The patient had no history of keloids. After obtaining his informed consent, the Q-switched ruby (Model 936R31-1; Lasermetrics, Englewood, New Jersey) was used with a pulse duration of approximately 20 ns. Four pulses were delivered sequentially: 7, 6, 5 and then 4 J/cm<sup>2</sup>. Pulse energy was measured with a meter (Model No. 1365, Scientech, Boulder, Colorado). No local anesthesia was used.

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## RESULTS

With each laser pulse, an immediate cutaneous micro-explosion occurred with visible spark formation and the projectile extrusion of a small piece of skin outward. There was also significant plume with a sulfur-like odor. The patient was left with edematous papules which healed over the next 2 weeks to reveal 5–8 mm diameter pox-like depressions. When seen in follow up about 6 months later, these scars were still present although they appeared slightly less deep.

## DISCUSSION

While Q-switched ruby lasers have a firmly established, excellent track record for the treatment of decorative tattoos, their role in the treatment of traumatic tattoos has been less well defined [1–13]. Generally, however, the experience has been quite satisfactory in that previous reports state efficacy with the removal of asphalt-based or gravel-based traumatic tattoos. Here we report a unique case of laser ablation of a tattoo composed of combustible particles. The temperatures reached at a microscopic level have been estimated to be on the order of 1,300°C, certainly high enough for plasma formation, as evidenced by the spark induction witnessed during our pulses [2,9]. Evidently the extreme temperatures reached transiently at the gunpowder granule level were sufficient for pyrolysis, causing ignition of the flammable residual debris in this patient's skin. What was most impressive was the projectile nature of the exploding skin plug, and the smell of burned sulfur after. The laser user is cautioned to take a careful history regarding the potential content of traumatic tattoos before treating them with any kind of laser. One potential safeguard is the use of transparent surgical dressing, preferably thin in diameter, to prevent any backfire of cutaneous debris which may occur. Because of this experience, I now routinely suggest using a plastic wrap or transparent sheet over

tattoos during laser ablation to minimize the potential biohazard. Concomitant smoke evacuation is also employed. For particles of a combustible nature, extreme caution is advised and the high risk of scarring should be noted.

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